$$Q_{stored} = Q_{generated} + Q_{in} - Q_{out} \quad (1)$$

where Q_{stored} is the amount of heat stored by the heat capacity of the material, $Q_{generated}$ is the amount of heat generated by the volume of material, Q_{in} is the heat transferred into the material from its surroundings and Q_{out} is the heat transferred out of the material to its surroundings.

When carrying out the present invention, it is advantageous to use a sample vessel as disclosed in SE 9704411-9. In such a sample vessel, the heat transport in a sample contained in the vessel is approximately the same in all directions. From now on the heat transport between the centre (Fig. 6, zone A) and the more peripheral (Fig. 6, zone B) part of a molten cast iron contained in a sample vessel is described. As the A zone is situated in the centre of the molten cast iron sample, and as that zone can be considered to be a freezing sphere, no heat is transported into the zone and Q_{in} is therefore equal to zero. Appropriate substitutions in relation (1) above give the following equation:

$$C_p m_A \, dT_A/dt = Q_{genA} + 0 - 4\pi ke \, [(T_A - T_B)/(1/r_1 - 1/r_2)] \quad (2)$$

where C_p is the heat capacity per unit mass, m_A is the mass of the A zone, dT_A/dt is the temperature change of the A zone per unit time, Q_{genA} is the heat generated in zone A, ke is the effective heat transfer coefficient of the material, and $(1/r_1 - 1/r_2)^{-1}$ is the mean distance for heat transport. The radii r_1 and r_2 are both defined in fig. 6. T_A and T_B are the temperatures in the A zone and B zone respectively.

From equation (2) we can isolate the heat generation term and calculate the average bulk heat generation in the A zone:

$$Q_{genA} = C_p m_A dTA/dt + 4\pi ke \, [(T_A - T_B)/(1/r_1 - 1/r_2)] \quad (3)$$

In equation (3) all variables are constants except dT_A/dt and $(T_A - T_B)$. Accordingly, equation (3) can be simplified to:

$$Q_{genA} = k_1\ dT_A/dt + k_2(T_A - T_B) \qquad (4)$$

where k_1 and k_2 are constants. Hence, a heat release curve can be calculated from a set of cooling curves recorded in the centre and the periphery of a sample of molten cast iron.

As already mentioned, these calculations are based on a situation where heat is uniformly transported in all directions. The skilled person can of course also calculate other equations corresponding to other heat transport conditions.

As mentioned earlier, the carbon equivalent of a certain cast iron melt affects the appearance of its corresponding cooling curves and heat release curves. Such cooling curves and heat generation curves can, depending on the carbon equivalent, be classified into one of four model types:

Type 1, which is disclosed in fig. 1, relates to hypo-eutectic cast iron. The cooling curve recorded in the centre of the sample is characterised by a first inflexion point associated with formation of austenite, followed by a local minimum. Interpretation of such curves does not present any particular difficulties and can be carried out in accordance with the principles outlined in WO86/01755 and WO92/06809. It should be noted that there is a peak (t_p) on the zone A heat generation curve that corresponds to the inflexion point (and accordingly with the onset of austenite formation) on the centrally recorded cooling curve.

Type 2, which is disclosed in fig. 2, relates to near-eutectic cast iron and is characterised by a very flat local minimum on the cooling curve recorded in the centre of the sample. An inflexion point cannot be seen. However, it is much easier to find a peak corresponding to the austenite formation point t_p on the heat generation curve.

In this case, it turns out that the austenite formation point t_p is located in connection to the local minimum resulting in a very flat minimum. From figures 2A and 2B it can be seen that t_p does not affect the slope at α.

Type 3, which is disclosed in fig. 3, also relates to near-eutectic cast iron, and is characterised by a detectable inflexion point after the local minimum in the cooling curve recorded in the centre of the sample. After determining the heat generation curve it is easy to establish the position of the austenite formation point t_p to a location immediately after the local minimum. However, in this situation the recalescence, and accordingly α is affected by the austenite formation. In order to be able to disregard the effects of the "moved austenite formation point" and to find a correct α located at t_α (where $t_\alpha > t_p$), the part of the centrally recorded cooling curve immediately adjacent to t_p, and having time values t such that $t - t_p$ are larger than a predetermined threshold value tv, are searched for a maximum value α_l of the first time derivative. This value α_l is then used as a correct α in the method. A suitable threshold value tv can easily be determined by the skilled person, but typical examples of such values are 1-5 seconds.

Type 4, which is disclosed in fig. 4A, relates to hyper-eutectic cast iron. This type is characterised in that no evident inflexion points or wide minima can be seen. The heat generation curve of the A zone does not comprise any detectable peaks. The present invention is not applicable in this situation.

It is preferred to carry out the prediction method by using a computer-controlled system, especially when a large number of measurements must be carried out. In this case, the same kind of sampling device 22 that has been described above is used. Such a computer-controlled system is outlined in fig. 6. During the measurement of a particular sample the two temperature-responsive means 10, 12 send signals to a computer 14 comprising a ROM unit 16 and a RAM unit 15 in order to generate the cooling curves. The computer device 14 is coupled to a memory means